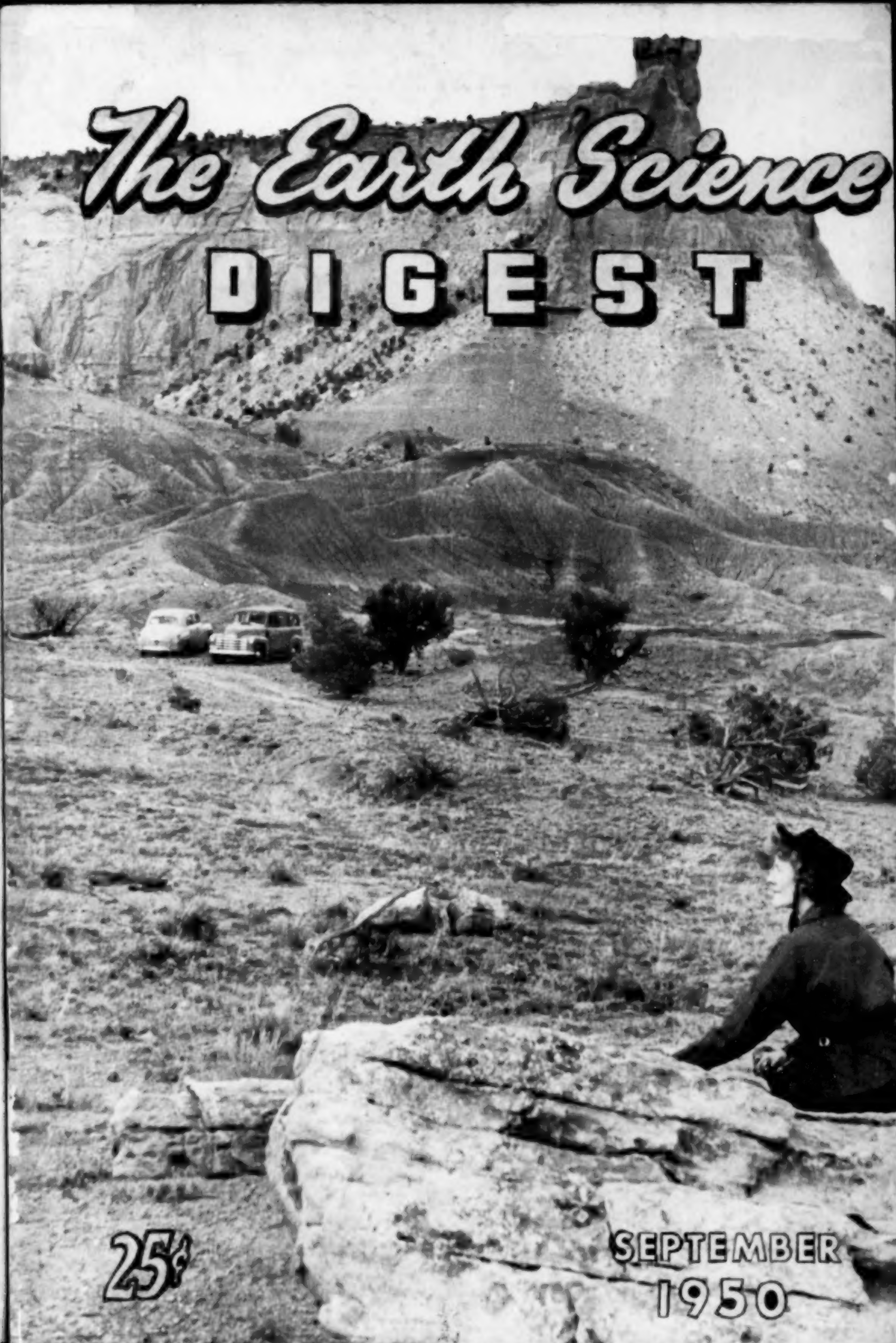
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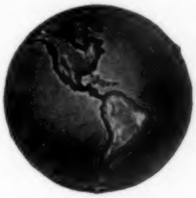

A magazine devoted to the geological sciences.

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- American Association of Petroleum Geologists; Society of Economic Paleontologists and Mineralogists; Society of Exploration Geophysicists. Pacific Section Annual Meetings. Oct. 19-20. Ambassador Hotel, Los Angeles, California.
- Permian Basin Oil Show. Oct. 19-22. Odessa, Texas.
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- Geological Society of America; Div. on Engineering Geology; Paleontological Society; Mineralogical Society of America; Society of Vertebrate Paleontology; Annual Meetings. Nov. 16-18. Washington, D. C.

Letters to the Editor

September 19, 1950

Dear Mr. Eisenberg:

In catching up on my reading since returning from the field, I was very interested to read the the articles in the Earth Science Digest on geology in the high schools. This subject is of considerable interest to our department since we are situated in an area where, until a few years ago, geology was very much undersold. Facing the usual difficulties of directly establishing geology courses in the high schools, we have devised an opening wedge which we feel has been quite successful.

This plan, inaugurated by Dr. Foose, head of our Department, has been built around presenting illustrated talks on geology in assembly programs at the schools. These programs are usually put on by one faculty member and one or two of our geology majors, if possible using a major from the school we are visiting. By doing this on a large scale here in Lancaster County, we feel we have acquainted a large number of students with what geology is all about. In fact, some of our present college geology majors say they had never heard of geology until we visited their high school and now they are hopeful of making careers in geology. In the course of these visits, we have uncovered another way to work geology into the high school curriculum, namely through their science clubs. An eagerness has been expressed to have us help them organize such projects but so far we have been unable to comply because of lack of time. However, for the present in Pennsylvania, this may be the best way to get geology into the high schools.

In putting on these programs, we have found colored slides to be our most effective vehicle up to this time. However, for a series of five talks at Philadelphia schools this year we are going to use colored movies of one of our field parties living and working in the Rocky Mountains. I think they will be better than slides, because more complete coverage of typical geologic work can be given.

The whole program of working geology into the schools is very complex. I think your conference was an excellent idea. We are working on the broad front of trying to build up an awareness of geology in the public mind, particularly at the high school level...

Sincerely yours,

JOHN HALL MOSS
Assistant Professor
Department of Geology
Franklin & Marshall College
Lancaster, Pennsylvania

COVER PHOTO

Typical beds of the colorful Chinle (Triassic) formation appear in the foreground, the hummocks behind the cars, and also in the slopes beyond in this photo of the Ghost Ranch dinosaur locality of the American Museum of Natural History in northwestern New Mexico. The cliffs in the distance consist of Wingate (Jurassic) sandstone. ("Entrada" of the U.S.G.S.) capped by the Todilto (Jurassic) formation. This locality was included in the itinerary of the Fourth Field Conference of the Society of Vertebrate Paleontology. See **Fossil Localities of Northwestern New Mexico,** pp. 3-9. Photo by H. P. Zuidema, University of Michigan.

FOSSIL LOCALITIES OF NORTHWESTERN NEW MEXICO

HENRY P. ZUIDEMA
University of Michigan

At a time of public jitters over flying saucers, A-bombs, or worse, the sight of a cavalcade of station wagons, jeeps, trucks, stock cars and a sound truck raising the dust this summer for more than a mile in the direction of Los Alamos could well cause a flurry of excitement.

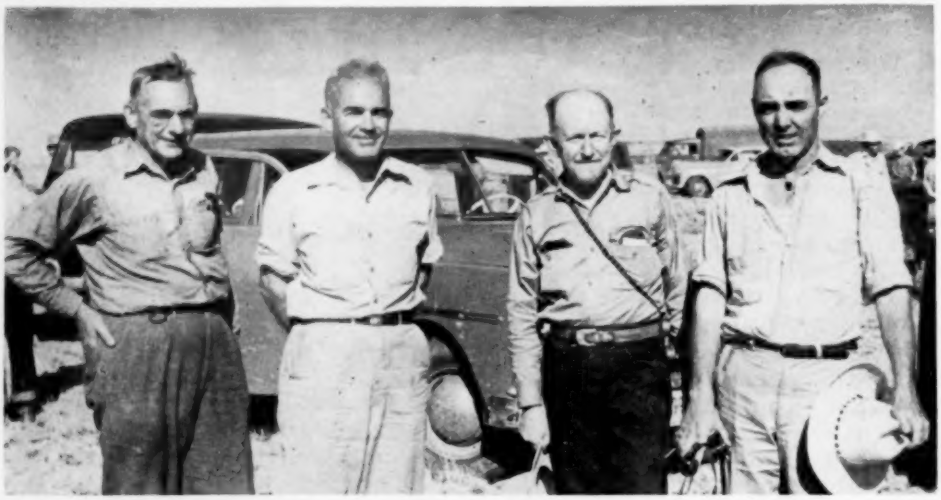
A lady tourist passing by did ask, apprehensively, upon seeing the SVP placards on each vehicle: "SVP? What's that?" The answer, "Society of Vertebrate Paleontology," seemed to confirm her worst fears, and her almost breathless reply was "Gosh!"

Although as much concerned as any other segment of the nation with current crises, the vertebrate paleontologists at this instant were deep in the Cenezoic (Santa Fe formation, Miocene-Pliocene) of the Rio Grande depression and soon were to penetrate even farther into the geologic past, at least as far back as the Pennsylvanian, during their annual tour of classical fossil localities and the sites of new discoveries of fossil mammals and reptiles.

This summer's excursion was the fourth field conference of the SVP and was confined to localities in northwestern New Mexico. The conference was sponsored by the American Museum of Natural History and the University of New Mexico. The leaders of the tour (and authors of an excellent guidebook, complete with photos, geologic maps and cross-sections) were Edwin H. Colbert and George Gaylord Simpson, both of the American Museum of Natural History; Stuart A. Northrop, of the University of New Mexico; and Alfred S. Romer, of Harvard University.

The conference get-acquainted session was held on the evening of June 20 in the Museum of Anthropology, Santa Fe, and Stanley Stubbs of the museum opened the splendid collections of Southwestern cultural material to the society in the late evening, after the initial meeting. Before outlining the tour and upon viewing an assemblage which included representatives of most North American universities and museums active in vertebrate paleontology, Dr. Simpson adroitly commented that "we had expected a small, select group, but we got a large, select group!"

Proceeding north from Sante Fe on the following day, the vertebrate paleontologists observed the exposures of the Sante Fe formation, a complex of Miocene-Pliocene sandstones, gravels and conglomerates washed down into the Rio Grande depression from the east from the ancestral Sangre de Cristo Range and attaining a thickness of some 2,000 to possibly 4,000 feet. Three contiguous areas in the north-central part of



Leaders of the Fourth Field Conference of the Society of Vertebrate Paleontology were (left to right): Alfred S. Romer, of Harvard University; Stuart A. Northrop, of the University of New Mexico; George Gaylord Simpson, and Edwin H. Colbert, both of the American Museum of Natural History. Photo by H. P. Zuidema.

the great depression have been found to be rich in mammalian fossils.

Of interest in this section are the abrupt ridges which from a distance appear to be igneous intrusives but actually are heavily cemented and resistant sand and conglomerate dikes. These were formed in fissures developed in fault zones in the Sante Fe formation and now, after extended erosion, stand out sharply on the landscape. Battleship Rock, near Abiquiu, is a remnant of one of these features.

Continuing north and west, along the east flank of the Jemez Mountains, the group reached the arroyo draining El Cobre Canyon, the broad floor of which is largely composed of the Abo (Permian) formation and the walls of Triassic red beds. It was in this canyon that David Baldwin, then collecting for O. C. Marsh (the specimens lay long neglected at Yale until Williston, thirty years later, worked up the material) found the hitherto unknown primitive reptile, **Limnoscelis.**

Climbing out of the Chama Valley, the paleontologists left behind the Cenozoic valley fills. Now a region of late Paleozoic to middle Mesozoic exposures opened up to view. Faulted exposures of what the tour leaders prefer to call the Wingate ("Entrada" of the U. S. G. S.) are across the river to the southwest. Farther south are exposures of the Chinle (Triassic) overlaid by the Tertiary Abiquiu tuff After passing a low crest, an amazing panorama lies ahead which, in the words of the tour leaders, "can hardly be surpassed, geologically, paleontologically, or scenically."

Visible are Pedernal Peak, an ancient landmark with its cap of igneous rock; the Mesa Alta (or Prieta), the Mesa de los Viejos, and Canjillon Mesa. The flanks of these table lands reveal the colorful section from the Triassic

Chinle to the Cretaceous Dakota.

The end of the first day's tour brought the fossil vertebrate hunters to one of the paleontological highlights of the conference — Alfred Newton Pack's 30,000-acre Ghost Ranch, site of the American Museum's now-famous dinosaur quarry.

A mile from the ranch buildings, three-quarters of the distance by jeep and the rest a steep climb, the quarry lies high on a Chinle slope.

Dr. Colbert recalled the history of fossil hunting in this part of New Mexico. After Baldwin's pioneer work in the 70's and 80's, there was a lapse of interest until Williston, Miller, Case and von Huene made their famous expedition of 1911. Then, in the 1930's, University of California parties under Camp and Welles took up the work and explored the Chinle, particularly at Ghost Ranch. The result was a fine series of phytosaurs. In the late 30's, White and Price investigated the Triassic at Ghost Ranch for Harvard, and collected that queer, elongated, armored reptile, **Typothorax.** In 1937 the American Museum of Natural History began work at the ranch and discovered a large series of primitive, small dinosaurs, of the genus **Coelophysis.**

The amateur fossil hunter often asks: "How do you know where to look, and how do you go about it?" The story of the AMNH discovery at Ghost Ranch is enlightening.

While many fossils had been found before in the Chinle in this part of New Mexico, the American Museum party believed that much remained to be discovered. The University of California expedition had provided ample indications in this direction.

One June morning, Dr. Colbert recalls, his party of three men had

Members of the Society of Vertebrate standing on the level of the famous dinosaur bone-bed of the American Museum of Natural History, at Ghost Ranch, New Mexico. Here paleontologists, directed by Dr. Edwin H. Colbert, have removed a large number of small dinosaurs, about six feet long and probably 50 pounds in weight when living. The dinosaurs are members of the Triassic genus Coelophysis. Photo by H. P. Zuidema.

been searching along the foot of the cliffs and along the talus slopes for fragments of fossil bones. They had worked slowly, ever upward on the slopes so that they would not inadvertently cover fossil scraps that were lying on the surface with debris kicked down by themselves. The work was for the most part unrewarding for only a few scraps, none very promising, were found.

As lunch time drew on, Colbert found George Whitaker, a member of the group, sitting in a car at

George Whitaker, whose finding of the tiny fragment of the claw of a small dinosaur led to the discovery of the Ghost Ranch dinosaur "graveyard". Photo by H. P. Zuidema.

the road below. Whitaker had some interesting fossils. One small scrap, no bigger that the end of one's finger, attracted the most attention. It was part of the claw belonging to one of the earliest and smallest dinosaurs. "This single fragment," said Colbert, "was to determine our entire season's work and lead a program that has required several years to complete."

The problem now was to find the source of the tiny fragment. High on the cliff, a layer of bones was discovered in the ancient, hardened Chinle clays. As the loose, weathered rock was carefully brushed away, fossils began to appear.

"It was especially exciting as we proceeded to uncover the bone layer to discover that the fossils were almost entirely of the little dinosaur," said Colbert. "We were finding almost complete backbones and legs. After a day or so we knew it would be necessary to begin operations on a big scale."

A road was built to the base of the cliff with a bolldozer so that supplies could be brought in and the huge blocks of fossils transported later to the ranch building, then to be shipped to the museum for careful preparation.

The bone layer was found to be an almost solid mass of dinosaurs. Some eighteen skulls could be counted at one time and skeletons frequently were so intertwined as to make it difficult to distinguish individual specimens. There was nothing to do except to cut through the bone layer so that blocks convenient to handle could be cut out. After these blocks had been protected with bandages of burlap dipped in plaster of Paris and strengthened with boards and heavy sticks, they were lowered by means of a derrick with chain and rope hoist to the foot of the cliff. They were then loaded on a heavy sled and pulled to the ranch headquarters by the bulldozer.

Examining the bone bed, the vertebrate paleontologists this summer soon were theorizing as to the circumstances surrounding the burial of the dinosaurs, all of them small, presumably upland creatures, about six feet in total length and weighing not more than 50 pounds in Colbert's opinion.

"It is evident that something must have killed great numbers of the dinosaurs," said Colbert. "There was much volcanic activity at the time, and a volcanic eruption may have been responsible. But we can only guess."

"The carcasses were deposited in a mass, perhaps in some sort of an eddy or backwater. The sediments appear to have been laid down on a stream bottom. These were very light animals and their bodies may have drifted farther than did the bodies of other reptiles of the time, so that there was some process of selection

Generalized Geologic Section — Northwestern New Mexico

Fourth Field Conference of the Society of Vertebrate Paleontology

[Compiled by Stuart A. Northrop for the Conference Guidebook]

	(Cuba-San Ysidro area)		(Abiquiu area)
PLEISTOCENE	Landslide, alluvium, terrace and pediment gravel; spring deposits		Basalt flows Bandelier rhylite tuff Puye gravel High-level basalt flows
	Rhyolitic to basaltic flows and tuffs, etc.		Canones andesite Canjilon till
PLIOCENE	Santa Fe formation and included flows		
MIOGENE	Abiquiu tuff (with Pedernal chert member)		
	El Rito formation		
OLIGOCENE (?)	Chicoma volcanics		
EOCENE		(San Juan Basin) Largo	
	San Jose fm.	Almagre	
		Tiffany	
PALEOCENE	Nacimiento formation	Torrejon Puerco	Animas formation to north
UPPER CRETACEOUS	Ojo Alamo sandstone Kirtland shale		
	Fruitland formation Pictured Cliffs ss. Lewis shale		
	Mesaverde fm.	Chacra ss. member La Ventana ss. m. Allison member Gibson coal member Hosta ss. member	
	Mancos shale	(to north) Upper shale member Niobrara shale m. Carlile shale m. Greenhorn ls. m. Graneros sh. m.	
	Dakota sandstone		
JURASSIC	Morrison formation Todilto limestone and gypsum Wingate ss. ("Entrada" of U.S.G.S.)		
UPPER TRIASSIC	Chinle fm.	Upper shale member (main body) Poleo sandstone lentil Salitral shale tongue Agua Zarca sandstone member	
PERMIAN	(to north) — ? —	San Andres fm.	(to south) Upper clastic m. Glorieta ss. m.
	Cutler fm.	Yeso formation	San Ysidro member Meseta Blanca ss. m.
		Abo formation	
PENNSYLVANIAN	Magdalena group	Madera ls.	Arkosic ls. member Lower gray ls. m.
		Sandia fm.	Upper clastic m. Lower ls. member
PRE-CAMBRIAN	Granite, schist, etc.		

Dr. George Gaylord Simpson, distinguished paleontologist of the American Museum of Natural History, takes the microphone at the sound truck to describe the fossil locality near Regina, New Mexico, on the continental divide. The exposures are the colorful San Jose formation (Eocene). Photo by H. P. Zuidema.

which concentrated these dinosaurs in one spot."

"When the current was no longer strong enough to carry them farther downstream, the small dinosaurs were covered with silt and the bones, protected against rapid decay, were slowly fossilized."

A spirited discussion ensued at the bone bed, with Dr. Charles L. Camp and Dr. Reuben A Stirton, both of California; LeRoy Kay, of Carnegie, and others offering possible explanations of the paleontological "jack-pot."

On the second day of the tour, the paleontologists, leaving U. S. Highway 84 to follow N. M. Highway 96, entered the San Pedro Mountain region. Before dropping into the valley of the Rio Puerco, the cavalcade stopped near the town of Coyote to view a section including the whole of the Permian and the Mesozoic into the Cretaceous.

Near Capulin, the group observed the grayish Todilto formation (Jurassic) forming the crest of Cerro Blanco, a hogback which dips sharply toward the road at this point, with the bright buff Wingate (Jurassic) appearing below. Near here lies another important vertebrate fossil locality, the type locality of Baldwin's **Typothorax.**

A salient feature of the landscape in this part of northwestern New Mexico is the Nacimiento uplift, lying to the east of the north-south Nacimiento thrust fault along which, in early Cenozoic times, pre-Cambrian granite was brought in contact with younger (Pennsylvanian to Eocene) beds with a maximum stratigraphic displacement of at least 3,500 feet.

In this area the vertebrate paleontologist finds historic ground. One of the arroyos was the site of E. D. Cope's second camp in 1874 and is the type locality of many of Cope's early Eocene mammals. A few miles away is the American Museum Quarry 88.

Near Regina, Dr. Simpson,

standing on a low ridge which is the divide between the Colorado (Pacific) and Rio Grande (Atlantic) drainage, indicated typical exposures at the Largo facies of the San Jose (Wasatchian) formation, pastel-colored sediments which have yielded **Meniscotherium,** a small Paleocene-Eocene ungulate, and other guide fossils.

The group camped for the night on the wide grounds of Los Pinavetes, the Simpson summer lodge in the pines above La Jara.

The third day of the tour found the paleontologists crossing the San Juan Basin from La Jara to Aztec. A good section of the Paleocene-Eocene transition lies along the route. Particularly striking along N. M. Highway 44 are the picturesque exposures of the somber, banded clays characteristic of the Nacimiento (Paleocene) formation.

Huerfano Mesa is a landmark in the basin, an erosion remnant in the Paleocene capped by a sandstone which is probably basal San Jose (Eocene).

The afternoon was occupied with visits to the head and bottom of Barrel Spring Arroyo. The sharp contact of the Cretaceous Ojo Alamo sandstone and the Paleocene Puercan clays is easily distinguishable from the trail dropping down into the arroyo. There are extensive exposures in this area of the Puercan and there is a rather rich upper fossil level from which have come most of the good specimens of **Taeniolabis,** a mammal which may have resembled in appearance the Australian wombat.

The official end of the tour was at the brink of Kutz Canyon, just off the highway leading to Aztec, where a magnificent badlands panorama in the Nacimiento formation may be enjoyed. A rich fauna of Torrejonian age was recently found at this locality by R. W. Wilson, of the University of Kansas, who is continuing his explorations in this locality.

The traditional feature of field trips, the scramble of those at the end of the caravan to catch the words of the tour leaders at the head of the line, was eliminated by use of a sound truck and vocal cords were spared as a loud speaker boomed out descriptions of formation and fauna.

At the last campfire (and sing) of the SVP, the choice of Mrs. Simpson was "Dem Bones Gonna Rise Again!" Considering the number of vertebrate paleontologists who were working in, or were en route to, the fossil localities of the West this summer, the prediction was a rather safe one.

U. S. G. S. GEOLOGIST FINDS FOUR NEW CRETACEOUS PLANT SPECIES

WASHINGTON, Sept. 15 — Four previously unknown plant species have been discovered by a U. S. Geological Survey worker in the course of geological studies in southwestern Colorado.

In a report on "Cretaceous Plants From Southwestern Colorado," published as Geological Survey Professional Paper 221-D, Dr. Roland W. Brown of the Survey describes the new species as Bolbitis coloradica and Llavea hesperia, both ferns; Mahonia furnaria, a member of the barberry family; and Celastrophyllum stokesi, a shrub belonging to the staff-tree family.

Dr. Brown's studies were undertaken in an attempt to determine the age of geologic strata lying between the carnotite - bearing sedimentary rocks of the McElmo (now called Morrison) formation and the overlying Mancos shale of Upper Cretaceous age in southwestern Colorado. Because few animal remains could be found, the scientist sought to attack the problem by studying fossil plants.

In his report, Dr. Brown describes two groups of plants, the first of which includes cycads — plants intermediate between tree ferns and palms — and the second consisting of ferns and well-developed flowering plants. He concludes that the Post-McElmo formation, which contains the cycads, is Lower Cretaceous — the geologic period characterized by the first appearance of birds and flying reptiles. The upper part of the strata, previously described as belonging to the Dakota formation, a conglomeratic sandstone containing the ferns and flowering plants, is Upper Cretaceous — the period when giant reptiles or dinosaurs were becoming extinct.

Copies of the report may be obtained at 20 cents from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

WATER RESOURCES

JULY 1950

Runoff was excessive over a broad area from Hudson Bay to the Gulf of Mexico. No major floods occurred in any large stream but severe flash floods hit many local areas particularly in Wisconsin, Iowa, and Nebraska. Winnipeg River and Red River of the North remain high following the spring floods.

Stream flow was excessive in the Pacific Northwest and much of Utah and Arizona; in southern California and New Mexico it remains deficient.

Runoff was deficient from southern Maine to eastern Ontario and groundwater levels were also generally below normal. Wells in northern New York were so low that hauling of water for livestock was reported. The outlook for August is that stream flow in central New England will not be more than half of normal unless there is above normal precipitation.

In the South, stream flow was generally near normal or above, except in eastern Georgia, and in southern Florida where ground-water levels in the Everglades area were the second-lowest of record and the lowest since 1945.

AUGUST 1950

Runoff was excessive over a broad region extending from Nebraska, Missouri, and Kentucky to the Gulf of Mexico. Stream flow was record-high for August at seven key gaging stations. Few notable floods were reported, however, and discharges were generally much less than those often occurring at other seasons.

The drought in the Southwest has returned in greater intensity. Reservoir contents are seriously low in some areas. Colorado River water was being used for irrigation and ground-water replenishment in lower Santa Ana River Basin in California. Ground-water levels continued to decline in some areas of New Mexico.

Excessive runoff in the Pacific Northwest and in Red River of the North Basin showed the effect of late spring floods. Storage in Stave Lake in British Columbia is greatly above average.

Runoff was deficient in South Carolina, Georgia, and Florida, reaching drought proportions in Georgia, but in some areas conditions were greatly improved by month-end rains.

— WATER RESOURCES REVIEW

Earth Science Abstracts

[Selected articles on the earth sciences, appearing in current scientific publications, are abstracted here for the convenience of our readers.]

EXPLORING THE OCEAN FLOOR. Hans Pettersson. **Sci. Am.,** Vol. 183, No. 2 (August 1950), pp. 42-45. Another account of the Swedish Deep-Sea Expedition on the **Albatross**. Geochronological methods are discussed. By applying the proportion of radioactive elements to the products of their decay, the author has been able to determine the rate of growth of central Pacific sediments for 250,000 years — a growth of less than 0.05 inches per 1,000 years. It concludes with a plea for international coordinated efforts in the study of the ocean floor.

GEOLOGY. Reginald A. Daly. **Sci. Am.,** Vol. 183, No. 3 (Sept. 1950), pp. 36-39. A survey of geological progress in the twentieth century. The author presents the following specific projects as those which should be undertaken in the future: 1) Detailed geological mapping to cover over 90% of the land area. 2) Exploration of the sea floor through echo sounding. 3) Seismological discovery of deep-seated discontinuities. 4) Further experimentation on the transmission of seismic waves by heated rock glasses under high pressure. 5) Further testing of the continental-drift hypothesis. 6) Discovery of the causes for the concentration of the earth's granite in the continents; the occurrence of the great granitic bodies in mountain ranges; the conversion of sedimentary rocks into crystalline rocks. 7) Further investigation of the mechanism of volcanic action. 8) Investigation of sedimentary rocks for the causes of long-term changes in the composition of the oceans and their effects on marine life evolution. 9) Studies of the causes of the ancient changes in world climate.

HISTORY OF THE FAUNA OF LATIN AMERICA. George Gaylord Simpson. **Am. Scientist,** Vol. 38, No. 3 (July 1950), pp. 361-389. A thorough, easily readable discussion of the animals of Central and South America, treating such topics as faunal strata, origins of the oldest faunal elements, faunal relationships with Africa (the "island-hoppers"), development of the native fauna, the late faunal mixture and its outcome, and the role of Central America in the faunal development of South America.

THE STRUCTURE OF ECUADOR. Victor Oppenheim. **Am. J. Sci.,** Vol. 248, No. 8 (Aug. 1950), pp. 527-539. The three tectonic provinces of Ecuador are the Coastal Province (between the Cordillera Occidental and the Pacific Ocean), the Eastern Province (east of the Cordillera Real, toward the Brazilian Shield), and the Central Andean Province (the high ranges of the Cordillera Real and the Cordillera Occidental, and the Inter-Andean basin). The magmatic Upper Cretaceous Western Cordillera preceded the rise of the Tertiary Cordillera Real, which is of geosynclinal and metamorphic constitution.

ASSAM QUAKE WAS ONE OF CENTURY'S TOP SEVEN

WATSON DAVIS
Director, Science Service

WASHINGTON, Aug. 29 — The gigantic Assam earthquake of Aug. 15, still rumbling in news filtering from the China-Burma-India border, was one of the seven quakes of top intensity in this century.

Not since the Japanese quake of March 2, 1933, had there been an 8½ intensity shock, the most severe the seismologist can record. In 1906 there were three such shocks: Colombia on January 31; San Francisco on April 18, and Chile on August 17. Then on Jan. 3, 1911, there was one in Tien-Shan on the China-Turkestan border, and on December 16, 1920, in the Kansu province of China.

The aftershocks of this month's record-breaker continue to jar the seismographs of the world, with many of the shakes major ones in themselves, like the one of seventh magnitude on August 18.

The region of this great quake is wild, remote, and mountainous, and only sparse population prevented deaths of tens of thousands of people. Undoubtedly there have been great mountain slides that dammed valleys and changed the face of the earth, although reports of the disappearance of mountains are over enthusiastic.

The U. S. Coast and Geodetic Survey located the center of the quake in the region of the northern Burma and China border, the epicenter being at 28½ degrees north latitude and 97 degrees east longitude.

QUEBEC CRATER MAY BE MARK OF ANCIENT METEORITE

WASHINGTON, August 11 — (Science Service) — Exploration of a supposed meteorite crater in northern Quebec, as reported from Toronto, is creating great interest among geologists. It is an ice-filled basin, about two and a half miles across, believed by Dr. V. Ben Meen, director of the Royal Ontario Museum of Geology and Mineralogy, to be caused by a great object from outer space that smashed into the solid granite crust of the earth there. It is larger than Meteor Crater in Arizona.

The meteoritic origin of the Quebec crater has not been bolstered by the finding of iron fragments as in the case of the Arizona scar or similar natural phenomena in Siberia and Australia.

Snow and ice even in summer hamper the search for positive evidence of fragments of the Quebec meteorite, and other expeditions will be needed.

The two best authenticated meteorite falls both occurred in Siberia. One on June 30, 1908, in northern Siberia was recorded on earthquake registering instruments but its effect was not nearly that of the scars produced in Arizona and Quebec. On Feb. 12, 1947, another Siberian fall, near Novopokrovka, peppered the earth, but again it was small in comparison with the presumed Quebec occurrence of thousands of years ago, now discovered.

URANIUM PROCUREMENT POLICIES

JESSE C. JOHNSON
U. S. Atomic Energy Commission

Only two years ago last April the Atomic Energy Commission announced a domestic uranium program designed to stimulate prospecting and to build a domestic uranium mining industry. The announcement stated that the Commission was leaving to the mining industry — the prospectors, the miners, and the mining companies—the job of finding, mining, and processing uranium ores. The Commission would assist by making geological surveys, by furnishing free testing and assaying service and, more important, by guaranteeing a market for the uranum ores.

The Government may be able to operate in some fields as efficiently as private industry. I know, however, that with a given price structure, the less Government there is in mining, the more production there will be. I am also convinced that the prospector, like the infantry-man, is not outmoded. We still need the prospector to find mineral deposits. The geologist's technical knowledge is no substitute for the optimism and persistence of the prospector, uninhibited by geological theories. Geological theories always can be developed to explain the occurrence of an ore deposit found under conditions previously considered unfavorable. I do not mean to belittle the importance of the geologist. The geologist is essential in evaluating and developing ore reserves and in finding ore, especially in broad mineralized areas such as the Colorado Plateau. However, even on the Colorado Plateau, where vanadium-uranium ores have been mined for years, the prospector is still at work. Probably one of the most important carnotite discoveries on the Colorado Plateau during the last twenty years came to light only a few months ago. It was found by some Navajos on the reservation near Shiprock, New Mexico. They may have known about the deposits for some time, but said nothing about them until leasing regulations were modified so that they could profit personally from their find. There, perhaps, we have an example of the profit incentive at work.

When the Commissioned announced its domestic uranium program, the vanadium-uranium ores of the Colorado Plateau were the only known source of domestic supply. That area had been mined for nearly fifty years and, although it had produced a relatively large tonnage, at no time were ore reserves large, including proven, indicated, and inferred ore. This was because the individual ore bodies are small, usually ranging from a few hundred to a few thousand tons, and are sparsely distributed through flat-lying sandstone extending over hundreds of square miles.

During the early part of the war, mine production far exceeded past records because of special incentives offered by the Government to get out vanadium. This program was terminated early in 1944 when adequate vanadium stocks had been accumulated. By 1946 the Plateau was practically a ghost camp with little vanadium and no uranium production. Four of the five process plants had been closed, and the fifth was operating at half capacity. Partly as a result of contracts from the Atomic Energy Commission for by-product uranium, a second plant was opened early in 1947.

This was the condition in the spring of 1948 when the Commission announced an ore-buying program with a schedule of prices for uranium and vanadium. There were only fifteen individual mining operations employing a total of 55 men, and a large part of the ore was coming from a vanadium deposit which contains very little uranium. Today there are over 200 different mining operations with total employment in excess of 1000. Ore production is at an all time high. The five process plants, three of them practically rebuilt, are now operating at capacity. The Climax Molybdenum Company has entered the field and is constructing a new mill at Grand Junction, Colorado. Several companies are studying the possibility of another new plant near Shiprock, New Mexico.

This increase in production has been achieved without Government financing of private operations. All of the ore is produced from privately-owned mines and over 80% is processed in privately-operated plants. Private investment in mines and mills during the two-year period has amounted to several million dollars. This indicates uranium mining can be a profitable business.

The Commission's exploration program on the Colorado Plateau has been important in maintaining and increasing ore reserves. This program includes 300,000 to 400,000 feet of diamond drilling a year. Important new sources of production found on public domain are being made available for private mining under lease arrangements. Private industry also is carrying on extensive drilling programs. We hope not only to maintain adequate ore reserves for existing plants, but to provide ore for new plants.

Prospecting and exploration, both Government and private, has not been confined to the Colorado Plateau. Nearly one hundred Government geologists are studying uranium occurrences in other parts of the United States. However, the success of any nationwide search for minerals depends upon enlisting the hundreds of prospectors, miners, and geologists who are out looking for all types of mineral deposits. They and their financial backers are the men who developed the American mining industry.

As an indication of public interest which followed the Commission's announcement of a domestic uranium program, during the past two years our laboratories have received more than 20,00 samples from various parts of the United States. We have had more than 12,000 letters about uranium occurrences. A prospector's handbook entitled "Prospecting for Uranium," prepared by the Commission and the Geological Survey, has been a "best seller." Since publication in May 1949, nearly 70,000 copies have been sold. It is available from the Superintendent of Documents at thirty cents a copy.

Interest in searching for uranium has not been confined to inquiries. Prospectors have been out in the hills digging. Little was reported during the first season, that of 1948, but during the summer of 1949 samples and reports of interesting finds began coming in volume. This year even more new discoveries have been reported and many of them are being prospected by surface cuts, underground workings and drilling. Many of our geologists are now engaged in examining deposits which have been found by miners and prospectors. Promising prospects have been found in Colorado, Utah, Arizona, New Mexico, Nevada, Wyoming, Idaho, Montana, and Michigan. It is too early to predict whether any of these new discoveries will become large mines, but I am confident from preliminary work that at least some will become important sources of uranium.

One of the most important of these new discoveries is near Marysvale, Utah, about 150 miles south of Salt Lake City. It was found by a prospector late in 1948, but little work was done until the summer of 1949. In the fall of 1949 it was brought to our attention. Although only a small amount of work had been done and only a limited amount of ore was in sight, the Commission decided to open an ore-buying station at Marysvale to furnish a market for development ore. This station began receiving ore on March 15th of this year and we now have a stockpile of about 10,000 tons.

At Marysvale, the low-grade surface ores (about 3.5% U_3O_8) contain the secondary uranium minerals, autunite and torbernite. Some of the underground workings, none of which are yet more than 100 feet below the surface, show uraninite, a uranium oxide considered by most geologists to be a primary mineral. Some recent shipments have assayed 0.8% U_3O_8 and we are hoping for important pitchblende deposits at greater depth. About a mile and a half from the deposits now being developed, a new discovery of autunite-torbernite ore was made recently, indicating an extensive area of uranium mineralization.

Development of mines and construction of mills require capital. If uranium mining is to be left to private industry, established mining companies must take the initiative in developing promising prospects and in producing uranium wherever economically feasible. Unless this is done, the Government will be forced into the mining business. Uranum production must keep pace with expanding requirements for national defense.

The mining companies are doing their part. On the Colorado Plateau, there are the U. S. Vanadium Corp., Vanadium Corp. of America, Climax Molybdenum Corp. and a large number of smaller operators.

Among the companies investigating or developing uranium deposits in other parts of the country are Jones and Laughlin Ore Company, Sunshine, Newmont, American Smelting and Refining, New Park, Golden Cycle, and others.

I hope that all mining companies will have their geologists and mining engineers on the lookout for uranium. Geiger counters should be standard equipment for every exploration department. Underground workings and drill cores should be checked for radioactivity. A radiometric survey was responsible for discovery of pitchblende in the lower workings of the Sunshine mine in Idaho.

Progress is being made in the search for uranium but greater effort is needed. The Commission recognized at the start that if the mining industry is to make this effort, the chances of reward must be commensurate with the risks involved. Our buying program was designed to provide an adequate incentive with the flexibility needed to meet new conditions.

Let me review briefly this program and show how it will apply to ores not covered by Circular No. 5, which relates to carnotite ores of the Colorado Plateau, or by Circular No. 1, which is for high-grade ores.

Circular No. 1, which established a ten-year guaranteed minimum price for high-grade ores and concentrates, was designed for high-grade pitchblende deposits of the type which in the past had furnished most of the world's uranium. Except for the Colorado carnotite deposits, which were covered by a special buying schedule, we had little basis for predicting the kind of uranium deposits which would be found in the United States. There had been little interest in, and little prospecting for uranium. We consider it likely that other deposits might be found to which the Circular No. 1 schedule would not apply. Therefore, a provision was included in Circular No. 1 for special arrangements under negotiated contracts when justified by the quantity and the cost of production.

Our experience during the past two years indicates that most domestic uranium ores will require special schedules. Therefore, there is need for a more definite statement of price policy — a statement which gives the essential terms of ore-buying schedules that may be established and also the basis upon which the Commission will purchase high-grade mill concentrates and precipitates.

Ore-buying schedules for crude ore not covered by Circular No. 1 or No. 5 will be established for each mill, based on the prices for uranium content set forth in Circular No. 5, the circular which applies to carnotite ore of the Colorado Plateau. Contracts for the construction and operation of mills will be arrived at by negotiation. It is expected that most of these contracts will be for the purchase of mill concentrates or precipitates at a unit price. The price paid for the mill product will be arrived at by taking into account ore cost and the estimated milling cost, including plant amortization, metallurgical losses and profit. For the purpose of such negotiations, all mills may be considered custom mills, even though the ore supply and mill may be owned by the same company. It is expected, however, that most mills will treat at least some custom ore.

This is the way new ore-buying schedules will be set up:

1. Price: \$2.50 to \$3.00 per pound of U_3O_8 content, depending upon grade, delivered at a mill. This price includes a development allowance of fifty cents per pound of U_3O_8 content.

2. In addition, a haulage allowance may be granted to defray part of the cost of moving the ore from mine to mill.

3. Ore specifications will be established by each mill and ore which does not meet specifications will not be accepted. Metallurgical tests also may be required to determine acceptability. The minimum U_3O_8 content for an acceptable ore may be from 0.20% to 0.30% U_3O_8, depending upon the type of ore.

4. Payment may be made for other valuable constituents of the ore provided the receiving mill can recover them economically. In general, payment for these other constituents will be based upon their market value, less deductions to cover metallurgical losses and the cost of milling,

transportation, smelting, refining, and marketing.

Although the formula I have outlined applies only to ores having a uranium content of 0.20% U_3O_8 or more, large deposits of lower grade material may be of interest to the Commission, depending upon the quantity of uranium available and the cost of production. For example, some very low-grade materials may be the source of by-product uranium. Every deposit of uranium should be brought to the attention of the Commission.

How long will the demand for uranium continue? In my opinion the market for uranium is here to stay, but when, if ever, there will be a free commercial market, I will not attempt to predict. As long as the Government is the sole purchaser of uranium, and industry must depend upon the Government for its market, the Government must give adequate guarantees both as to price and the period of purchase, if industry is to finance and operate uranium mines and plants.

The Commission has approved the price policy I have just outlined. It will remain in effect until March 31, 1958, subject only to changes or modifications which will not be less favorable to the producers. This means an assured market for uranium ore at minimum prices for approximately eight years. Circular No. 5, which applies to carnotite ores of the Colorado Plateau, now effective until June 30, 1954, also will be extended to March 31, 1958.

Let me say in closing that the expanded national defense program carries increased requirements for uranium. Thus far we have been able to meet requirements for all existing operations and new programs. Given ample notice, and the necessary men and materials, almost any requirement can be met — at a price. In this country there are vast deposits of shales containing small amounts of uranium which could be recovered if cost was no object. Cost, however, has been a factor, and cost in terms of manpower, materials, and time, always will be a factor. We must get what we need but the price we — the taxpayers —pay should not be in excess of what is necessary to fulfill our needs.

[This article was condensed from an address by Jesse C. Johnson, Manager, Raw Materials Operations, United States Atomic Energy Commission, at the Meeting of the American Mining Congress, Salt Lake City, Utah, August 30, 1950.]

SECOND CONFERENCE ON THE TEACHING OF THE EARTH SCIENCES

A second Conference on the Teaching of the Earth Sciences, sponsored by the Earth Science Institute, will be held at Harvard University, Cambridge, Mass., on Friday and Saturday, March 16 and 17, 1951. The program will be devoted to teaching in the secondary and elementary school levels. Suggestions as to the program and to the content of the Conference should be addressed to the Chairman of the Conference, Dr. C. W. Wolfe, Dept. of Geology, Boston University, 725 Commonwealth Ave., Boston 15, Mass.

GEOCHEMICAL PROSPECTING FOR ORES

PART ONE OF A TWO-PART ARTICLE

JEROME M. EISENBERG

By the application of sensitive chemical tests, traces of elements or gases may be detected in soils, vegetation, water, and even animals, which may indicate the presence of valuable underlying deposits of ores or hydrocarbons. This recently developed method of searching for economic mineral deposits is called geochemical prospecting. As early as 1922, C. H. White proposed a method of prospecting for copper in which the rock in place and detritus was examined for copper with the blowpipe. The Russians first recognized the value of geochemical anomalies about 1930. V. A. Sokolov suggested in 1932 that oil deposits might be discovered through the analysis of the gases present in the overlying soil. Geochemical methods of prospecting for sulfide deposits were proposed at about the same time.

Geochemical prospecting for ores was also investigated by geologists in Sweden, Finland, Norway and Germany before World War II. The first papers published on this subject (1935-1936) dealt primarily with the analysis of soils as a prospecting method, particularly for the determination of primary tin deposits.

The following principles of a geochemical method of prospecting for ores are condensed from V. P. Sokoloff's translation of "Geochemical Method of Prospecting for Ore Deposits", by E. A. Sergeev (from **Materials of the Soviet Union Geological Institute, Geophysics,** Fascicle 9-10, pp. 3-55). The illustrations were also taken from this paper, which appeared in "Selected Russian Papers on Geochemical Prospecting for Ores", translated by V. P. Sokoloff and H. E. Hawkes (U. S. Geological Survey, Feb. 1950).

DISPERSION

Table 1 shows the percentage of the economically important metals in the earth's crust, their orders of magnitude of concentration in economically valuable deposits, and the ratios of these figures. The striking differences between the amounts of metals in the earth's crust and the amounts found in deposits are attributed to the behavior of the metals in the basic cycle of matter in the earth's crust, such as the one proposed by V. I. Vernadski (Fig. 1).

Different chemical elements are affected in different ways in this basic cycle. The compounds of some elements have a cyclicity produced in the course of migrations, accompanied by regular changes in concentrations; and

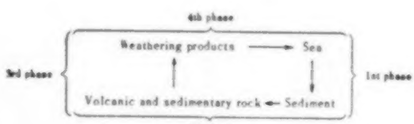


Figure 1 — The weathering cycle (according to Vernadski).

TABLE 1.

The concentration of elements in their economic deposits in relation to their concentrations in the earth's crust (according to Sargeev.)

Element	K (percent in earth's crust, according to Clarke)	P (percent in economic deposits)	P: K
Aluminum	8.080	10x*	< 10
Iron	5.080	10x	~ 10
Magnesium	2.090	10x	~ 100
Phosphorus	0.157	~ 10	10 to 100
Manganese	0.124	10x	~ 100
Sulfur	0.080	10x	~ 100
Chromium	0 068	10x	~ 100
Vanadium	0 041	1x	~ 100
Nickel	0.031	1 to 10	~ 100
Copper	0.010	~ 10	~ 1000
Zinc	0.004	~ 10	~ 1000
Lead	0.002	~ 10	1000 to 10,000
Cobalt	0.003	1 to 10	~ 1000
Boron	0.001	~ 10	~ 10,000
Molybdenum	0 0001x	~ 10	~ 10,000
Tin	0.0001x	1 to 5	~ 10,000
Arsenic	0 0001x	5 to 10	10,000 to 100,000
Antimony	0.00001x	5 to 10	~ 100,000
Cadmium	0.00001x	0.5 to 1	10,000 to 100,000
Mercury	0.00001x	1 to 5	~ 100,000
Silver	0.000001x	0.0001	100 to 1000
Bismuth	0.000001x	~ 1	~ 1,000,000
Gold	0.0000001x	0.0001	~ 1000

* x is a factor between 1 and 10.

the development of geochemical anomalies will sometimes result in the formation of valuable mineral deposits.

The processes which lower the metallic concentration of the enriched zones are referred to as **dispersion processes;** the corresponding period of time being the **dispersion phase.**

During the course of the fourth phase (dispersion), in addition to the main trend of the entire deposit, which is undergoing dissipation, local secondary cyclicity periodically changes the concentration of elements in the general directional course of the migration, away from the ore body. The space in which this migration is developing is termed the **geochemical field of dispersion.** The field of dispersion develops in three successive stages: the **dispersion halo,** the **dispersion train,** and the **secondary accumulation.** The dispersion halo is a zone of geochemical anomalies, ranging from the highest values of the ore body to the lowest in the country rock. The dispersion train is the spatial element of the field between the dispersion halo of one local phase with that of the next local phase. Secondary processes unrelated to the primary dispersion may produce a **false halo of dispersion,** with no actual connection between the dispersion train and the deposit. It is the study of the dispersion halo and the dispersion train, establishing the presence of geochemical anomalies for the element in question, which forms the basis of the geochemical method.

DISPERSION HALOS

Gaseous Halo. Gases trapped beneath impermeable layers, under greater - than - atmospheric pressure, migrate toward the direction

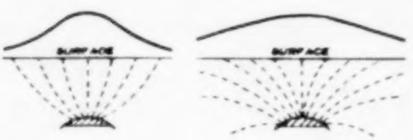


Figure 2 — The distribution of gas near the daylight surface; graphs for gases of different density (according to Sokolov).

of lower pressures, or the surface, in obeying the law of diffusion. This is considered to be the fundamental dispersion process.

In the case of a regularly-domed deposit, with a covering rock uniform in its properties, the concentration of the gas along the path of migration will vary as the square of distance from the source, producing a concentration curve in the profile through the dispersion halo with a regular form (fig. 2). Because the character of the gaseous halo is influenced by structural elements, diversity of composition, barometric and thermal fluctuations, and meteorological and biochemical factors, the application of mathematical analysis has a limited usefulness.

Mechanical Dispersion Halo. If the valuable element is chemically stable in the zone of weathering, then it is subject only to physical or spatial changes, while the ore body is being successively transformed. The halo develops above the outcrop of the deposit which is being buried through the continuous physical destruction of the outcrop, with the direct entrance of the valuable minerals into the eluvium (residual deposits) and the continuous removal of the loose (deluvial) materials. The movement of deluvium is probably caused by the diminishing of the mutual cohesion of the particles (through periodic moistening and atmospheric precipitation), and

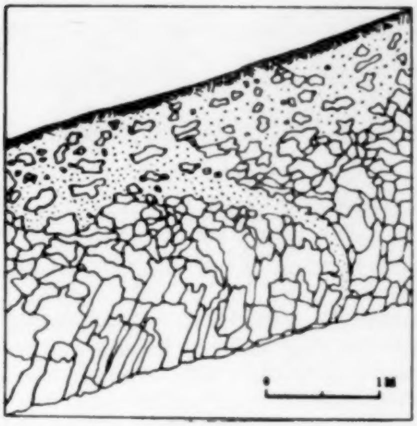


Figure 3 — Creep structure; a section through soil.

diurnal and annual temperature fluctuations, causing periodic contraction and expansion of the mass.

With the weakening of cohesion, individual particles are transposed a certain distance away from the surrounding particles, the sum total of these individual movements establishing movement of the whole mass. The resulting **creep structure** is shown in figure 3. The curved form of the fractures is caused by the decrease in the velocity of movement with an increase in depth.

The resulting displacement of the upper horizons with respect to the lower will produce a halo corresponding to the cross-section shown in figure 4b. Another consequence of this creep is a lateral dispersion effect, which will be at a maximum in the upper horizons of deluvium. The vein may extend in the direction of deluvial creep or parallel to the contour lines (Figures 4 and 5; **b** is a vertical cross-section of the halo perpendicular to the vein; **c** is the plan view of the halo; and **a** is the diagram of concentration in profile $M\text{-}M_1$.).

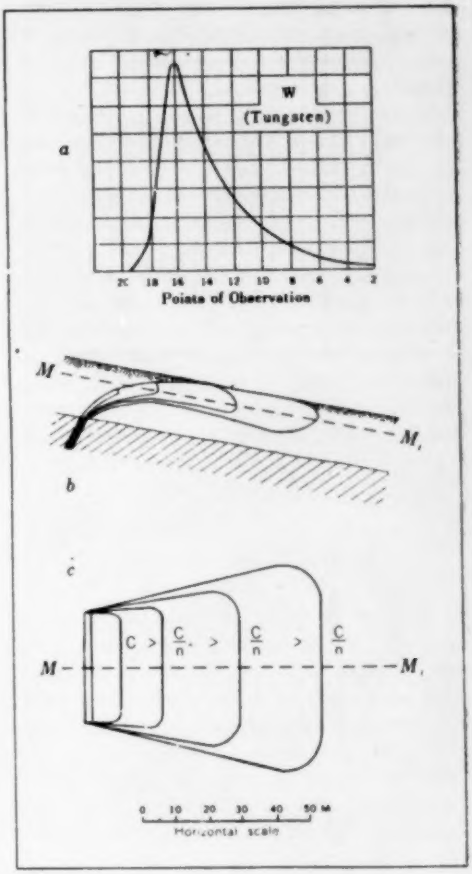


Figure 4 — The halo of a vein striking parallel to the contour lines.

Intermediate forms of halos will be produced by all other possible positions of vein deposits with respect to relief. The train of dispersion develops when the movable material enters into the sphere of action of perennial aqueous streams. The formation of local secondary accumulations and placer deposits may accompany this process.

Saline and Complex Halos. Ores chemically unstable in the oxidized zone develop dispersion fields

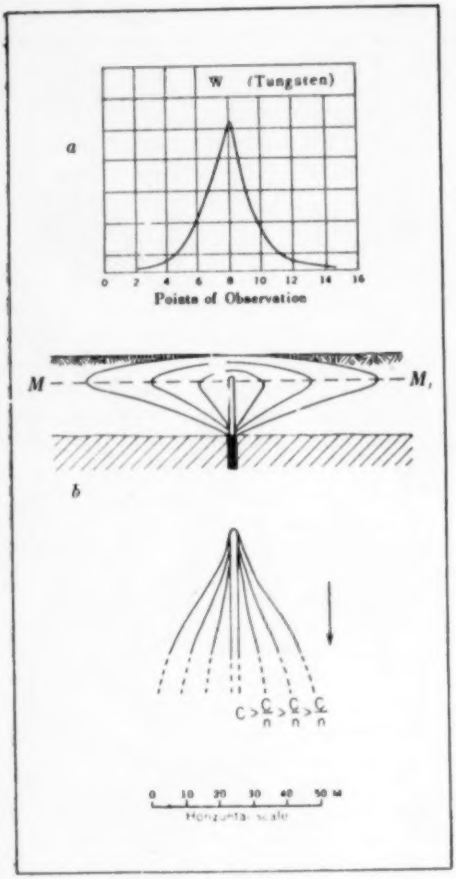


Figure 5 — The halo of a vein striking parallel to the direction of movement of soil.

through oxidation and solution. During the transformation of the ore minerals, which finally form compounds of maximum stability, intermediate aqueous, salt, or colloidal solutions are developed by atmospheric or ground waters, which are carried away by vadose and ground-water trains. If the oxidized zone is inadequately supplied with water, the saline halo may be noticeably enriched. Arid regions are favorable for the development and fixation of saline lispersion halos.

[END OF PART 1]

Yuma-Like Javelin Heads Found In 5,000-Year-Old Campsite

HOT SPRINGS, S. D., Aug. 10 (Science Service) — Digging with a bulldozer under 20 feet of dirt deposited by winds and floods of centuries, scientists of the Smithsonian Institution found a site where Indians had camped some 5,000 years ago. The discovery was made at the Angostura Reservoir near here.

Under the direction of Richard P. Wheeler, they dug up some ancient stone javelin heads. With the stone weapons were some animal bones, in such bad condition that it is impossible to tell whether they are the remains of extinct animals or whether they are of species still living.

The javelin heads are very much like the Yuma points found some years ago in New Mexico together wth the fossils of extinct animals. The Yuma points are the finest job of flint chipping found in the New World in spite of their great antiquity.

The Angostura site is one of a number of reservoir sites being explored for archaeological treasure before they are flooded.

At the Garrison Reservoir in North Dakota, archaeologists under the direction of G. Ellis Burcaw found a fortified Indian village like others previously found along the Missouri River. The village is encircled by a moat and stockade built on packed earth walls with watchtowers at frequent intervals. It was like the European fortified villages of the Middle Ages, but was built in America before the coming of the white man.

New Books

All books listed here are deposited in the Library of The Earth Science Institute and may be borrowed by the members. Books marked with an asterisk may be purchased through The Earth Science Publishing Co., Revere, Mass.

*SUBSURFACE GEOLOGIC METHODS. Compiled and edited by L. W. LeRoy. 2nd Edition, 1950. viii, 1166 pp., 12 pls., 600 figs.; $7.00. (Dept. of Publications, Colo. School of Mines, Golden, Colo.)

The excellent reception accorded the first edition, which was published in June, 1949, brought about this revised and enlarged edition, which includes new sections on secondary-recovery methods, evaluation of petroleum properties, geochemical methods, micrologging, drill-stem testing, mud chemistry, cementing problems, acidization, shale-density analysis, and graphic methods in mining. The series of questions at the end of each chapter will be of great value to teachers using this book as a text or supplementary reading. A much-needed comprehensive index has been included in this edition. This concise and comprehensive symposium is an indispensable volume for the student and professional worker, and should go through many more editions, especially if the publisher continues to present it at such a reasonable price.

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NON-INDUSTRIAL RESEARCH IN THE GEOLOGICAL SCIENCES — 1950. Compiled by Joseph L. Gillson. 1950. vi, 80 pp.; $1.00.

GEOLOGICAL GUIDE BOOKS AND ROAD LOGS IN THE UNITED STATES. Compiled by F. W. Rolshausen and S. W. Lowman. 1850. iv, 78 pp.; $1.00 (Reports 3, 4; American Geological Institute, 2101 Constitution Ave., Washington, D. C.

These reports were prepared by the Geological Information Committee of the American Geological Institute. The former is a tabulation, arranged by subject matter and author, of almost 3000 projects of non-industrial geological research in North America. This publication will do much toward the prevention of duplication of work, the exchanging of information, and the progress of geological research in general in this country. We hope that we may see this publication appear annually. The latter report is a catalog of geological guide books and road logs which has long been needed. It will prove to be a useful reference for those desiring information as to publications on the best exposed and readily available outcrops in certain areas.

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*LAKE SUPERIOR AGATE. Theodore C. Vanasse. 1950. 64 pp., 44 figs.; $1.50. (The **Sun**, Spring Valley, Wisconsin.)

This publication is an outgrowth of the author's article "A Study of Lake Superior Agate" in the August and September-October 1947 issues of the **Earth Science Digest.** The sub-varieties of Lake Superior Agate are described and illustrated. An attractively-bound booklet, it is an interesting addition to the library of the mineralogist, collector, or lapidary.

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BEDROCK TOPOGRAPHY OF ILLINOIS. Leland Horberg. 1950. 112 pp., 2 pls., 23 figs.; free. (Bull. 73, Illinois State Geological Survey, Urbana.)

This study is intended primarily as an aid in locating the major bedrock valleys (along which are located the most important water-bearing glacial sands and gravels), evaluating their aquifers, and determining general groundwater conditions throughout the glaciated area. The report treats in detail the physiographic divisions of the bedrock topography, the bedrock valley systems, their erosional history, and their groundwater resources. Maps of the bedrock surface and of the preglacial drainage systems of the State are included.

OTHER PUBLICATIONS RECEIVED

ILLINOIS MINERAL INDUSTRY IN 1948. Walter H. Voskuil, 1950. 74 pp., 16 figs.; free. (Rept. of Investigation 147, Illinois State Geological Survey, Urbana.)

STRUCTURE OF HERRIN (No. 6) COAL BED in Marion and Fayette Counties and Adjacent Parts of Bond, Clinton, Montgomery, Clay, Effingham, Washington, Jefferson, and Wayne Counties. Raymond Siever. 1950. ii, 100 pp., 1 pl., 2 figs.; free. Circ: 164 Illinois State Geological Survey, Urbana.)

SUMMARY OF STRATIGRAPHY SHOWN IN GEOLOGIC CROSS-SECTION OF ILLINOIS BASIN. L. E. Workman, D. H. Swann, and Elwood Atherton. 1950. ii, 18 pp.; free. (Circ. 160, Illinois State Geological Survey, Urbana.)

GEOLOGY AND GROUND-WATER RESOURCES OF RICE COUNTY, KANSAS. O. S. Fent. 1950. 142 pp., 11 pls.; 11 figs.; $0.25. (Bull. 85, Kansas State Geological Survey, Lawrence.)

COAL RESOURCES OF MICHIGAN, G. V. Cohee, R. N. Burns, Andrew Brown, R. A. Brant, and Dorothy Wright. 1950. 56 pp., 1 pl., 37 figs.; free. (Circ. 77, U. S. Geological Survey, Washington, D. C.)

STATUS OF FEARN SPRINGS FORMATION. Frederic F. Mellen. 1950. 20 pp., 9 figs.; free. (Bull. 69, Mississippi State Geological Survey, University.)

CALLUM CREEK, LANGFORD CREEK, AND GAP MAP-AREAS, ALBERTA. R. J. W. Douglas. 1950. viii, 124 pp.; 8 pls., 26 figs.; $1.00. (Memoir 255, Geological Survey of Canada, Ottawa.)

DEVONIAN SECTIONS IN THE ROCKY MOUNTAINS BETWEEN CROWSNEST PASS AND JASPER, ALBERTA. R. de Witt and D. J. McLaren. 1950. ii, 66 pp., 1 fig.; $0.10. (Paper 50-23, Geological Survey of Canada, Ottawa.)

ACTINOCAMAX FROM THE UPPER CRETACEOUS OF MANITOBA. J. A. Jeletzky . . . (and)

SCIOPHYLLUM, A NEW RUGOSE CORAL FROM THE CANADIAN ARCTIC. P. Harker and D. J. McLaren. vi, 44 pp., 4 pls., 3 figs.; $0.25. (Geol. Survey Bull. 15, Geological Survey of Canada, Ottawa.)

GEOLOGY OF BONAVISTA MAP-AREA, NEWFOUNDLAND. A. M. Christie. 1950. ii, 40 pp., 1 pl.; $0.10. (Paper 50-7, Geological Survey of Canada, Ottawa.)

GHOST LAKE MAP-AREA, NORTHWEST TERRITORIES. G. M. Wright. 1950. ii, 10 pp., 1 pl.; $0.10. (Paper 50-13, Geological Survey of Canada, Ottawa.)

GEOLOGY OF TECK TOWNSHIP AND THE KENOGAMI LAKE AREA, KIRKLAND LAKE GOLD BELT. Jas. E. Thompson . . . (and)

GEOLOGY OF THE MAIN ORE ZONE AT KIRKLAND LAKE. Jas. E. Thompson, et al. 1950. viii, 196 pp., 20 pls., 62 figs.; $1.00. (57th Ann. Rept., Part V, 1948, Ontario Dept. of Mines, Toronto.)

NORTHWEST DASSERAT TOWNSHIP, TEMISCAMINGUE COUNTY, QUEBEC. K. R. Dawson. 1950. ii, 28 pp., 1 pl.; $0.10. (Paper 50-3, Geological Survey of Canada, Ottawa.)

A TECHNIQUE FOR THE DETERMINATION OF TRACES OF EPIGENETIC BASE METALS IN ROCKS and its Application to Samples of Unaltered and Altered Rock Surrounding Ore-bodies of the Amulet Mine, Noranda, P. Q. John E. Riddell. 1950. ii, 24 pp., 2 pls.; free. (P. R. 239, Quebec Dept. of Mines, Quebec.)

RAZILLY MAP-AREA, ABITIBI-EAST COUNTY, O. D. Maurice. 1950. iii, 17 pp., 4 pls.; free. (Geological Rept. 41, Quebec Dept. of Mines, Quebec.)

POTENTIAL MINERAL RESOURCES OF YUKON TERRITORY. H. S. Bostock. 1950. ii, 30 pp., 1 fig.; $0.10. (Paper 50-14, Geological Survey of Canada, Ottawa.)

ANTIMONY DEPOSITS OF EL ANTIMONIO DISTRICT, SONORA, MEXICO. D. E. White and Reinaldo Guiza. 1949 (1950). iv, 112 pp., 13 pls., 2 figs.; $0.70. (Bull. 962-B, U. S. Geological Survey, Washington, D. C.)

MINERALS AND ENERGY ADMINISTRATION ESTABLISHED

WASHINGTON, Sept.27—Establishment of a Mineral and Energy Administration within the Department of the Interior to administer the defense responsibilities delegated to the Department under the Defense Production Act of 1950 was announced today by Secretary of the Interior Oscar L. Chapman.

Secretary Chapman will be Administrator of the new Administration which will be made up of four industry agencies. Each agency will be headed by an Assistant Administrator, to carry out operating functions in each of the areas for which the Interior Department has responsibility, including electric power, petroleum and gas, solid fuels, and metals and minerals.

A Requirement Committee will be established, Secretary Chapman said, to advise the Administrator on the allocation among claimants of resources under the jurisdiction of the Department and on the assignment of priority ratings. The Administrator will serve as chairman of the committee and membership will include representatives of Government agencies acting as claimants.

Secretary Chapman said that the fullest possible use will be made of industry advisory committees organized to conform to the Defense Production Act, in each of the areas in which the Department has jurisdiction, in order to facilitate administration and to assure adequate consultation and advice from industry members.

Secretary Chapman said that a number of key officials have been designated on a temporary basis to aid in setting up the new defense organization. Alfred C. Wolf, director of the Department's Program Staff, has been named acting executive assistant to Secretary Chapman to coordinate the work of this temporary staff.

"One of the reasons for assigning defense responsibilities to existing Executive Departments is to make full use of the knowledge and competence of these agencies in their special fields," Secretary Chapman said. "The men who will help me in setting up the Administration have been chosen on the basis of their special knowledge and competence in the fields to which they have been assigned."

Mr. Wolf, who was a lieutenant commander in the U. S. Navy during World War II, later served as special assistant to the Housing Expediter and as a member of the staff of the Office of War Mobilization and Reconversion. He has been a member of the Interior Department's Program Staff since 1947.

Other temporary appointments include the interim designation of Hugh A. Stewart, Director of the Department's Oil and Gas Division, to handle defense activities in the field of petroleum and gas. Before joining the Department in 1949, Mr. Stewart had been oil and gas consultant, with offices in Denver, Col. From 1923 to 1948 he was employed by the Texas Company as chief geologist and in various production capacities.

D. L. Marlett, assistant administrator of the Bonneville Power Administration, has been named in the interim to handle defense matters in the electric power field. Mr. Marlett has worked for BPA since 1939 and has been assistant administrator since 1945. He had previously been administrative assistant to the chairman of the Illinois Commerce Commission and lecturer in public utilities at Northwestern University.

Defense activities in the field of solid fuels are to be handled, for the present, by Dan H. Wheeler, who has been assistant director to the Department's Division of Territories since last May. Mr. Wheeler has worked for the Department of the Interior since 1939, serving successively as assistant director and director of the Bituminous Coal Division, assistant deputy and Deputy Solid Fuels Administrator for War, and assistant director of the Department's Program Staff.

James Boyd, Director of the Bureau of Mines since 1947, has been appointed to head the Metals and Minerals Agency, Secretary Chapman said. A former professor of geology and dean of the faculty of the Colorado School of Mines, Dr. Boyd rose from captain to colonel during World War II, serving as chief of the Metal Section, Office of the Under Secretary of War, executive director to the director of material, Army Service Forces, and advisor on materials to the American representative on the Combined Raw Materials Board. After the war, he was director of the Industry Division Office of the American Military Government in Germany.

George Lamb, assistant to the president of the Pittsburgh Consolidated Coal Company, has been appointed a consultant to Secretary Chapman to aid in organizing a staff to administer defense functions in the solid fuels field. Mr. Lamb was assistant director of the Bureau of Mines from 1945 to 1947 and had previously been chief economist for the Department's Bituminous Coal Division.

Functions of the Administration's industry agency will be to: expand and maintain the supply of the raw materials or services for which the divisions have responsibility; prepare estimated requirements for equipment, supplies, transportation and storage facilities, and manpower required for the supply programs; distribute the resources under their jurisdiction consistently with allocation and priority determinations; assure maximum use and conservation of productive resources used by industries under the jurisdiction of these divisions; initiate proposals under Title III of the Defense Production Act for Department guarantee of loans, certification of need for loans and purchase, and installation of Government-owned equipment; promote conservation by consuming industries and the public; recommend industry-regulating and consumption-regulating orders for issuance by the Administrator; recommend price policies to the Administrator; collect and analyze statistics on supply and distribution of resources.

Secretary Chapman emphasized that component parts of the Administration will have only minimum staff and that maximum use will be made of existing facilities of the Department. The Assistant Secretaries of the Department, in addition to supervising the management of the continuing resource development program of the Department, will be responsible for assuring that programs of Bureau and Offices over which they have immediate supervision are adjusted to meet defense needs and are properly integrated with the programs and operations of the Mineral and Energy Administration.